Geophex Airborne Unmanned Survey System (GAUSS)

Developer: Geophex, Ltd.
Contract Number: DE-AR21-93MC30358
Crosscutting Area: CMST

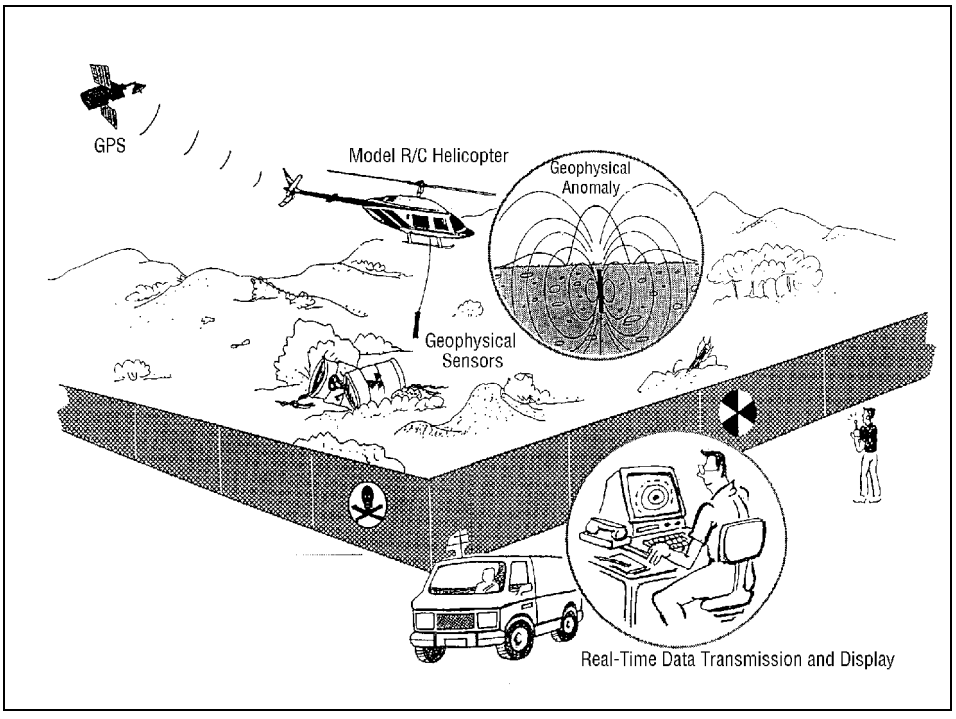
Subsurface Contaminants FOCUS AREA

Problem:

Geophysical surveys of environmental sites provide a nonintrusive means of evaluating subsurface conditions, yet for many sites, conditions are sufficiently hazardous that personnel cannot enter the site, or elaborate personal protective equipment may be required. Technologies are needed to rapidly characterize subsurface conditions at contaminated sites without placing personnel at risk. Conventional airborne technologies cannot fly near enough to the surface to detect small, buried targets.

Solution:

The Geophex Airborne Unmanned Survey System (GAUSS) is an airborne survey platform having geophysical sensors designed to survey and detect buried environmental hazards. GAUSS can be remotely flown within a few feet of the ground to detect weak magnetic and/or electromagnetic anomalies attributed to small buried unexploded ordnance (UXO) items, explosive waste, and other buried targets (e.g., drums and trenches) in areas contaminated by hazardous chemical or radioactive materials. GAUSS provides a truly "standoff" survey platform, since it can "stand-above" a suspect object without touching the ground while the sensors can "hover-above" within a few feet of the object. This ability to be close to the targets, but off- and above-the-ground, allows GAUSS to be completely nonintrusive, yet satisfies the crucial technical requirement that the sensors be close to the target to be detected and characterized by magnetic and electromagnetic means, the two most common and convenient geophysical methods.



Benefits:

- Subsurface surveys where ground-based platforms cannot be deployed
- Rapid geophysical surveys of large areas
- Personnel remain at "standoff" distances
- Geophysical sensors can "stand-above" near to target objects
- Automated data collection and reduction

Technology:

A miniature, remote-controlled helicopter (RCH) carries magnetic and electromagnetic sensors only a few feet above the ground surface,

allowing rapid sweeps of suspected areas for both metallic and nonmetallic anomalies. Sensor heights of only a few feet allow detailed detection of small objects without requiring proximity of personnel or other equipment. Digital telemetered data and real-time processing provides rapid sweeping capability. Digital position data are acquired with the sensor data for automated data reduction and analysis.

The instrument package on the RCH consists of sensors, sensor signal processing electronics, a central processing computer, an altimeter, and a digital data link. The base-station system consists of a digital data link for communication with the airborne platform, a laser-tracking unit, a portable computer executing process control software, command and control software, and vehicle position and data display software.

Geophysical sensors carried by GAUSS include a digital fluxgate magnetic gradiometer and a multifrequency electromagnetic unit, both of which have been developed and engineered by Geophex. Geophex used off-the-shelf commercial products, where possible, to reduce cost and design time.

Project Conclusion:

At the completion of this project the GAUSS was demonstrated at the Geophex contructed 1/4 acre geophysical test site. The test site included buried objects placed at known depths (3-6 feet) and orientations. The test facility, located on Geophex property, was designed to be realisitic: nearby structures and two buried utilities contributed background noise that competed with the target anomalies.

This project was completed in September 1996. The GAUSS successfully demonstrated the ability to simultaneously collect, process, display, and store positional and geophysical data in real-time (i.e., identify the right buried projects) while the survey vehicle, RCH, carried a magnetometer in random motion.

Geophex has also further developed this technology utilizing electromagnetic sensor technology and they have successfully located septic systems, tunnels, and waste containing covered ditches. The technology may have decontamination and decommissioning (D&D) application for locating potentially contaminated drain lines.

Contacts:

Geophex, Ltd. has a ten year history of advancing technology for geophysical exploration of the shallow subsurface. For information on this project, the contractor contact is:

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